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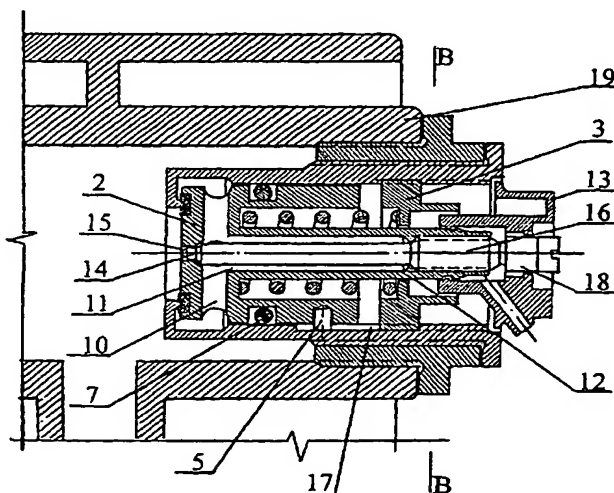
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(54) Title: RELIEF VALVE



(57) Abstract: A relief valve comprises a cylindrical body (1) with an inlet opening including a seat into which the working end of a piston (2) abuts. A spring (6) presses the piston (2) to the seat through an adjusting nut (3) mounted to move on a thread of the internal surface of the body (1). The piston (2) is provided with radial openings (10) arranged in a single plane extending perpendicular to the axis of the stem (12) and communicating with an axial opening (11) of the stem (12). The external surface of the stopper (4) is provided with a shoulder for receiving a manual valve control key, and a drain tip (13) is fixed at the end of the stem (12). According to the second modification, a needle (14) is mounted in an axial bore of the stem (12) to form a needle-type valve with an axial bore of the piston (2). The needle (14) is provided with a threaded boss (16) engageable with the thread on the internal surface of the stem (12), said internal surface of the stem (12) is provided with longitudinal fluid passages (17), and a drain tip (13) is fixed at the end of the stem (12).

WO 02/46651 A1

RELIEF VALVE

FIELD OF INVENTION

The invention relates to relief devices mounted in heating systems, in particular,
5 radiators, and adapted for releasing air to relieve the excessive pressure.

BACKGROUND OF THE INVENTION

A known device is designed for the manual-mode release of air from heating units of
a water-type heating system. Air release in such device is provided in case of occurrence of
10 air locks impeding the normal water circulation in the heating system (author's certificate
SU 1737210 A1, IPC F16K 24/00, published on 1992).

Also known is a relief valve comprising a cylindrical body with an inlet opening
having a seat against which abuts the working end of a piston that is provided with a
pressure seal gasket. The piston is made integral with a stem axially aligned with a spring
15 that presses the piston to the seat through an adjusting nut mounted for movement over a
thread on the internal surface of the valve body. A seal is lodged in a circular groove on the
side surface of the piston. A stopper with an axial stem opening is mounted on the valve
body at the side opposite to the inlet opening (the catalogue of the FAR firm, filing number
SQU408AQ045, Gozzano (NO), Italy, 1998, p. 20). The valve of this type provides the
20 release of heat-carrier from a pipeline in case the pressure of the heat-carrier exceeds the
predetermined value, but does not provide air release in case of occurrence of air locks.

The recent heating units manufactured from high heat transfer materials, in particular,
aluminum, are characterized by low time lag permitting the heating units to be locally
adjusted. However, the feasibility for adjustment may lead to the detachment of the heating
25 unit from the entire system. The increase of an environment temperature, generation of an
air-gas mixture, occurrence of a hydraulic shock etc, may cause the pressure increase in the
hermetically sealed unit beyond the margin of safety and, as a result, the failure thereof.

SUBSTANCE OF THE INVENTION

30 An object of the present invention is to increase the performance reliability by
eliminating the possibility of breakdown of a radiator, when the fluid pressure within it
exceeds the predetermined value, by releasing the air from the radiator. Another object of
the present invention is to reduce the external dimension of a valve by locating working
parts within the radiator and to widen the functional capabilities of the valve.

The present invention may be used for releasing the air from the manual-mode water-type heating units, as well as for providing automatic reduction of pressure in a heating system.

Two embodiments connected by a single conception of the invention are as follows:

5 In accordance with the first embodiment, a safety valve comprises a cylindrical body with an inlet opening having a seat against which abuts the working end of a piston provided with a pressure seal gasket. The piston is made integral with a stem axially aligned with a spring that presses the piston to the seat through an adjusting nut mounted for movement on thread provided on the internal surface of the valve body. A circular
10 groove in the side surface of the piston is adapted for receiving a seal.

A stopper with an axial stem opening is mounted on the valve body at the side opposite to the inlet opening. The piston has radial openings arranged in a single plane extending perpendicular to the axis of the stem, between the circular groove and the working end of the piston, and communicated with an axial opening in the stem.
15 Longitudinal channels in the side surface of the piston above the circular groove and in the internal surface of the valve body are provided for receiving a member that prevents the piston from rotation. A thread on the external surface of the stem is adapted for meshing with a thread in the axial opening of the stopper which is disposed in a bore of the valve body end, wherein the bore is provided with a support base. A shoulder on the external
20 surface of the stopper is provided for receiving a manual valve control key. A drain tip is mounted on the stem end.

In accordance with the second embodiment, a safety valve comprises a cylindrical body with an inlet opening having a seat against which abuts the working end of a piston provided with a pressure seal gasket. The piston is made integral with a stem axially
25 aligned with a spring that presses the piston to the seat through an adjusting nut positioned for movement on a thread provided on the external surface of the valve body. A circular groove provided in the side surface of the piston is adapted for receiving a seal. The piston has radial openings communicated one with the other, arranged in a single plane extending perpendicular to the axis of the stem between the circular groove and the working end of
30 the piston, and connected to the axial opening of the stem. The side surface of the piston above the circular groove and the internal surface of the valve body are provided with longitudinal channels wherein a member preventing the piston from rotation is disposed. A needle is positioned in the axial opening of the stem to define a needle-type valve with a piston axial opening. The needle is provided with a boss having a thread engageable with

the thread on the internal surface of the stem. Longitudinal fluid passages are made in the aforementioned internal surface of the stems. A drain tip is mounted on the stem end.

In a particular case, the spring may be lodged deep into a circular axial channel in the piston, and a slot may be provided in the side surface of the piston between the working end
5 and the circular groove.

BRIEF DESCRIPTION OF THE DRAWINGS

The substance of the invention is illustrated by means of the accompanying drawings:

Fig.1 is a general view of the relief valve in accordance with the first embodiment;

10 Fig.2 is an A-A sectional view (as is shown in Fig. 1);

Fig.3 is a general view of the relief valve in accordance with the second embodiment;

Fig.4 is a B-B sectional view (as is shown in Fig. 3) .

BEST EMBODIMENTS OF THE INVENTION

15 According to the first embodiment of the present invention, a relief valve comprises a cylindrical body 1 with an inlet opening. The internal surface of the cylindrical body 1 has a thread adapted to be engaged with an adjusting nut 3, and the external surface has a thread permitting location of the relief valve in a radiator. The end of the cylindrical body 1 opposite to the inlet opening is provided with a bore having a support base 9 wherein a
20 stopper 4 with a shoulder for receiving a manual valve control key is disposed. A piston 2 has a working end which abuts against a seat in the inlet opening of the cylindrical body 1 and which is provided with a circular groove wherein a seal 7 is positioned for preventing fluid from flowing into the upper part of the body 1. Radial openings 10 between the working end of the piston 2 and the circular groove are in fluid communication with an
25 axial opening 11 of a stem 12 that is formed integral with the piston 2. A spring 6 located in a piston circular opening that is axially aligned with the stem 12 abuts against the adjusting nut 3. The design of the spring 6 is chosen such that the distance "h" between the rear side of the piston 2 and the lower surface of the adjusting nut 3 is at least equal to the value of a piston stroke upon actuation of the relief valve under the effect of pressure exceeding a
30 predetermined value. This condition is true for the devices in accordance with the first and second embodiments. The satisfactory maintenance is facilitated in case the depth of bore L at the end of the body 1 is chosen at the rate of $L > h$. In the internal surface of the body 1 and in the part of the piston 2 disposed above the circular groove are formed longitudinal channels wherein a member 5 is located for preventing the piston 2 from rotation. A

pressure seal gasket 8 is attached to the working end of the piston 2. The thread on the external surface of the stem 12 is engageable with the thread in an axial opening of the stopper 4. A drain tip 13 is fixed at the end of the stem 12. The external surface of the body 1 is provided with a thread permitting the relief valve to be located in a radiator 19.

5 In accordance with the second embodiment, a relief valve comprises a needle 14 inserted into an axial opening 11 in the stem 12 to form a needle-type valve with an axial bore 15 in the working end of the piston 2. A boss 16 at the opposite end of the needle 14 has a thread engageable with the thread on the internal surface of the stem 12, wherein fluid passages 17 are made. A screw-driver receiving slot is disposed at the end 18 of the needle
10 14. Bore holes on the end of the stem 12 are adapted for receiving projections formed on the internal surface of the drain tip 13 manufactured from, for instance, polyethylene. Because of the close fit, the drain tip 13 is tightly connected to the cylindrical surface of the upper part of the needle 14 to prevent fluid escape.

In accordance with the first embodiment of the present invention, the device is
15 operated in the manner described hereinafter. To provide for satisfactory operation of the device, it is preferably assembled in accordance with the following instructions. The piston 2 with the spring 6 is mounted in the body 1. The adjusting nut 3 is brought into an initial contact with the spring 6 by rotating it on the thread of the body 1, with following compression of the spring 6 by further rotating the adjusting nut 3 by means of a wrench
20 that applies force of predetermined pressure for which the relief valve is to be adjusted. The upper surface of the adjusting nut 3 is preferably disposed at the level below the support base 9. The stopper 4 is then screwed onto the piston stem 12 until it comes into contact with the support base 9. The drain tip 13 is mounted at the end of the stem 12.

When fluid pressure in the radiator exceeds the predetermined value during operation
25 of the device, the piston 2 is shifted within the body 1 by this pressure, and the fluid in the radiator is passed through a gap defined between the piston end and the seat of the body 1 into the body 1, and is further directed into the transverse openings 10 and via an opening 11 in the stem 12 of the piston 2 and the drain tip 13 is discharged into the atmosphere.

The value of the predetermined pressure causing the relief valve to open is defined by
30 the pressing force applied to the seat of the inlet opening in the body 1 by the spring 6 at the end of the piston 2.

The relief valve provides air release from the radiator 19 in a manual mode. When assembled, the stopper 4 contacts the support base 9. When rotated in the clockwise direction, the stopper 4 rests upon the support base 9, and rotation thereof is restricted by

said support base. Due to the employment of the member 5, the stem 12 is not rotated together with the stopper 4, but performs progressive movement with respect to the body 1 as a result of engagement of the thread on the stem 12 and the threaded internal axial opening in the stopper 4, to cause the working end of the piston 2 to move. As a result, the air is released into the atmosphere the same way as in the previous case. Upon discharge of air from the radiator 19, the stopper 4 is rotated in the counterclockwise direction. The piston 2 is urged by the spring 6 so that it abuts against the seat to close the opening in the body 1.

In accordance with the second embodiment of the present invention, the device is operated in the following manner. During assembling of the relief valve, it is adjusted for predetermined pressure in the manner similar to that of the first embodiment of the present invention. Then the needle 14 is fixed in the stem 12 so as to tightly close an axial bore 15 in the end part of the piston 2 by rotating the needle in the clockwise direction on the threaded boss 16, with the following mounting of the drain tip 13 on the end of the stem 12.

When pressure in the radiator exceeds the predetermined value, the piston 2 is operated in the manner similar to that of the first embodiment of the present invention. Water flows into the valve body 1 and is further directed via radial openings 10, axial opening 11, passages 17 into the cavity of the drain tip 13 and via the outlet opening thereof is released into the atmosphere.

To discharge the air in a manual mode, the needle is preferably rotated in the counterclockwise direction through a number of turns by means of a screw driver received in the slot at the end 18 of the needle 14, with the piston 2 being prevented from rotation by the member 5. The needle 14 is thus unscrewed from the stem 12 to open the axial bore 15. The air is discharged from the radiator via the axial opening 11 in the stem 12 and passages 17 into the atmosphere.

The present invention provides a relief valve allowing the reliability and operation of the radiator to be improved and maintenance thereof to be simplified.

CLAIMS

1. A relief valve comprising a cylindrical body (1) with an inlet opening
5 including a seat against which abuts the working end of a piston (2) that is provided with a
pressure seal gasket (8), the piston (2) made integral with a stem (12) axially aligned with a
spring (6) that is compressed by an adjusting nut (3) positioned to move on a thread formed
on the internal surface of the body (1), the side surface of the piston (2) being provided with
a circular groove for receiving a seal (7), a stopper (4) having an axial opening for passage
10 of the stem (12), is characterized in that the piston (2) is provided with radial openings (10)
arranged in a single plane extending perpendicular to the axis of the stem (12), between the
circular groove and the working end of the piston (2), and being in fluid communication
with the axial opening (11) of the stem (12), and that the side surface of the piston (2)
above the circular groove and the internal surface of the body (1) are provided with
15 longitudinal channels wherein a member (5) is located for preventing the piston (2) from
rotation, and that the external surface of the stem (12) is provided with a thread engageable
with the thread in axial opening of the stopper (4) that is disposed in a bore at the end of the
body (1), said bore being provided with a support base (9), and that the external surface of
the stopper (4) is provided with a shoulder for receiving a manual valve control key, and at
20 the end of the stem (12) a drain tip (13) is fixed.

2. A relief valve according to claim 1 is characterized in that a spring (6) is
located deep into a longitudinal axial bore in the piston (2).

25 3. A relief valve according to claim 1 or 2 is characterized in that a slot is
disposed on the side surface of the body (1) between the working end of the piston (2) and
the circular groove thereof.

4. A relief valve comprising a cylindrical body (1) with an inlet opening
30 including a seat against which abuts the working end of a piston (2) provided with a
pressure seal gasket (8), the piston (2) is made integral with a stem (12) axially aligned with
a spring (6) which is in contact with an adjusting nut (3) that is movable on the thread
formed on the internal surface of the body (1), the side surface of the piston (2) is provided
with a circular groove wherein a seal (7) is disposed, is characterized in that the piston (2)

is provided with an axial opening (11) and radial openings which are communicating one with another and disposed in a single plane extending perpendicular to the axis of the stem (12), between the circular groove and the working end of the piston (2), said axial opening and radial openings being connected to the axial opening of the stem (12), the side surface
5 of the piston (2) above the circular groove and the internal surface of the body (1) are provided with longitudinal channels for receiving a member (5) preventing the piston (2) from rotation, and a needle (14) is disposed in the axial opening (11) of the stem (12) to form a needle-type valve with an axial bore (15) of the piston (2), said needle (14) is provided with a boss (16) having thread engageable with the thread on the internal surface
10 of the stem (12), said internal surface including longitudinal fluid passages (17), and a drain tip (13) is fixed at the end of the stem (12).

5. A relief valve according to claim 4 is characterized in that a spring (6) is located deep into a longitudinal axial bore in the piston (2).

15

6. A relief valve according to claim 4 or 5 is characterized in that a slot is made on the side surface of the body (1) between the working end of the piston (2) and the circular groove therein.

Claims 1 and 4 are to be stated in a new wording according to enclosed substituting sheets (Appendix #1),

Claims 2, 3, 5 and 6 unchanged.

The changes relating to claims 1 and 4 are exhibited in Appendix # 2 by the italicized font.

Appendices: 1. Substituting sheets # 6 and # 7 of the claims, on two sheets, in triplicate.

2. Sheets # 6 and # 7 of the claims with changes, on two sheets, in one copy.

CLAIMS

1. A relief valve comprising a cylindrical body (1) with an inlet opening
5 including a seat against which abuts the working end of a piston (2) that is provided with a pressure seal gasket (8), the piston (2) made integral with a stem (12) axially aligned with a spring (6) adapted for biasing the piston (2) up to the seat and equipped with an adjusting nut (3) positioned to move on a thread formed on the internal surface of the body (1), the side surface of the piston (2) being provided with a circular groove for receiving a seal (7),
10 a stopper (4) having an axial opening for passage of the stem (12), is characterized in that the piston (2) is provided with radial openings (10) arranged in a single plane extending perpendicular to the axis of the stem (12), between the circular groove and the working end of the piston (2), and being in fluid communication with the axial opening (11) of the stem (12), with a member (5) being located between the side surface at the piston (2) and the
15 internal surface of the body (1) for preventing the piston (2) from rotation, and in that the external surface of the stem (12) is provided with a thread engageable with the thread in axial opening of the stopper (4) which is disposed in a bore at the end of the body (1), said bore being provided with a support base (9), and that the external surface of the stopper (4) is provided with a shoulder for receiving a manual valve control key, and at the end of the
20 stem (12) a drain tip (13) is fixed.

2. A relief valve according to claim 1 is characterized in that a spring (6) is located deep into a longitudinal axial bore in the piston (2).

25 3. A relief valve according to claim 1 or 2 is characterized in that a slot is disposed on the side surface of the body (1) between the working end of the piston (2) and the circular groove thereof.

4. A relief valve comprising a cylindrical body (1) with an inlet opening
30 including a seat against which abuts the working end of a piston (2) provided with a pressure seal gasket (8), the piston (2) is made integral with a stem (12) axially aligned with a spring (6) adapted for biasing the piston (2) up to the seat and equipped with an adjusting nut (3) positioned to move on the thread formed on the internal surface of the body (1), the side surface of the piston (2) is provided with a circular groove wherein a seal (7) is

disposed, is characterized in that the piston (2) is provided with an axial opening (11) and radial openings (10) which are communicating one with another and disposed in a single plane extending perpendicular to the axis of the stem (12) between the circular groove and the working end of the piston (2), said axial opening (11) and radial openings (10) being
5 connected to the axial opening of the stem (12), with a member (5) being located between the side surface at the piston (2) and the internal surface of the body (1) for preventing the piston (2) from rotation, and a needle (14) is disposed in the axial opening (11) of the stem (12) to form a needle-type valve with an axial bore (15) of the piston (2), said needle (14) is provided with a boss (16) having thread engageable with the thread on the internal
10 surface of the stem (12), said internal surface including longitudinal fluid passages (17), and a drain tip (13) is fixed at the end of the stem (12).

5. A relief valve according to claim 4 is characterized in that a spring (6) is located deep into a longitudinal axial bore in the piston (2).

15

6. A relief valve according to claim 4 or 5 is characterized in that a slot is made on the side surface of the body (1) between the working end of the piston (2) and the circular groove therein.

1/2

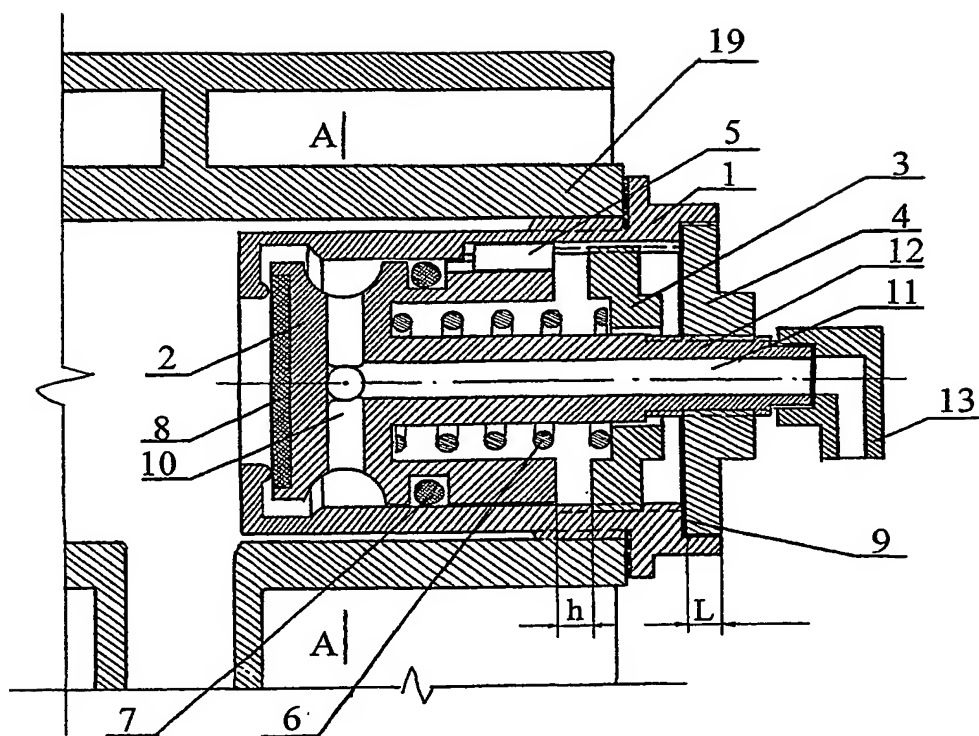


Fig. 1

Section A-A

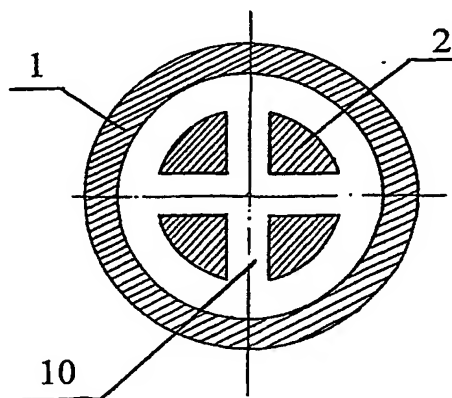


Fig. 2

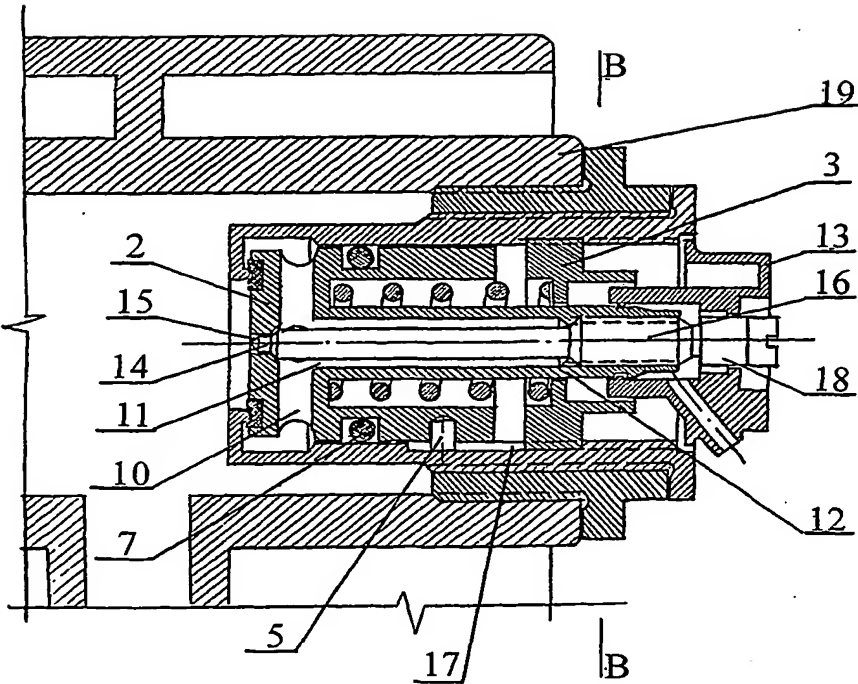


Fig. 3

Section B-B

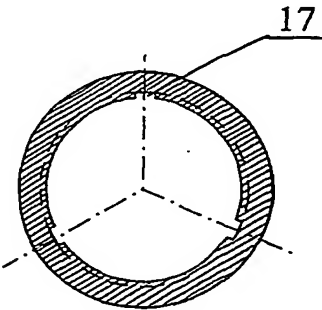


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 01/00057

A. CLASSIFICATION OF SUBJECT MATTER

F16K 17/168

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F16K 17/00, 17/02, 17/04, 17/168, 24/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched:

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
A	GB 2108631 A (L.A. RUMBOLD LIMITED) 18 May 1983	1-3
A	RU 2154229 C1 (ЗАКРЫТОЕ АКЦИОНЕРНОЕ ОБЩЕСТВО "ОРЛЭК") 10.08.2000	1, 2
A	US 5215116 A (RICHARD VOSS GRUBENAUSSBAU GMBH) Jun. 1, 1993	1, 2, 3
A	WO 85/02893 A1 (CATERPILLAR TRACTOR CO.) 4 July 1985	4, 5, 6

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex

* Special categories of cited documents:

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"&" document member of the same patent family

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